Name _____ Date _____

Chemistry
Lab – Solubility of a Salt

The solubility of a pure substance in a particular solvent is the quantity of that substance that will dissolve in a given amount of the solvent. Thus, solubility must be expressed as quantity of solute per quantity of solvent at a specific temperature. For most ionic solids, especially salts, in water, solubility varies directly with temperature. That is, the higher the temperature of the solvent (water), the more solute (salt) that will dissolve in it.

In this experiment, you will study the solubility of potassium nitrate (KNO_3) in water. You will dissolve different quantities of this salt in a given amount of water at a temperature close to the water's boiling point. Each solution will be observed as it cools, and the temperature at which crystallization of the salt occurs will be noted and recorded. The start of the crystallization indicates that the solution has become saturated. At this temperature, the solution contains the maximum quantity of solute that can be dissolved in that amount of solvent.

After solubility data for several different quantities of solute have been collected, the data will be plotted on a graph. A solubility curve for KNO_3 will be constructed by connecting the plotted points.

Purpose
Collect the experimental data needed to construct a solubility curve for potassium nitrate in water.

Materials

balance	test tube holder	graduated
hot plate	test tube rack	cylinder
spoon	beaker	stirring rod
test tubes	thermometer	potassium nitrate

Procedure
You and your partner will be assigned to specific test tubes. Write the numbers of the test tubes you will be doing here:

Test tube 1 – Carefully measure and add exactly 2.0 g of KNO_3
Test tube 2 – Carefully measure and add exactly 4.0 g of KNO_3
Test tube 3 – Carefully measure and add exactly 6.0 g of KNO_3
Test tube 4 – Carefully measure and add exactly 8.0 g of KNO_3

1. Add exactly 5.0 mL of water to each test tube.
2. Fill a large beaker about three-fourths full with tap water. Prepare a hot water bath by heating this on the hot plate.
3. Place your test tubes into the hot water bath and stir them with a stirring rod to help dissolve the KNO_3. When the KNO_3 is completely dissolved, place a warmed thermometer into the test tube. Remove the test tube from the hot water bath.
4. Watch the test tube carefully and record the temperature as soon as you see crystals start to form.
5. After all your test tubes have crystallized clean up and work on the calculations!

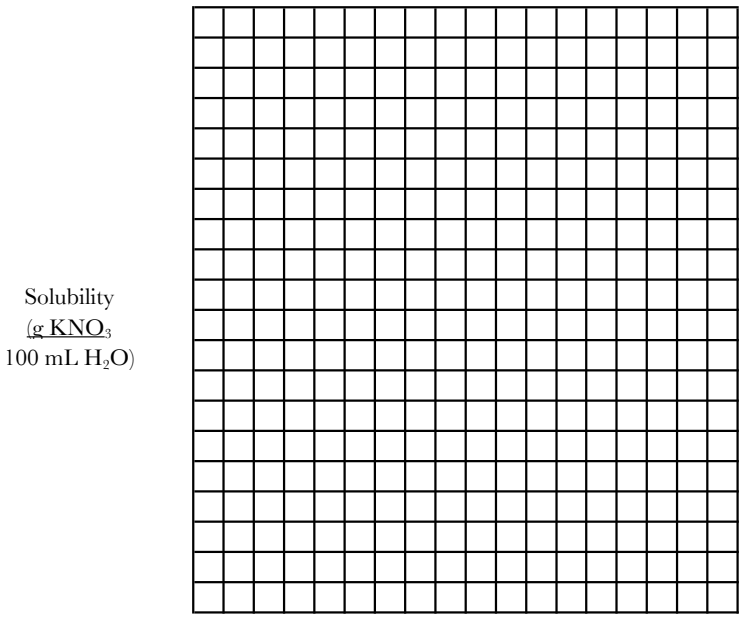
Observations and Data

Test Tube Number	Grams of KNO_3 / 5 mL Water	Crystallization Temperature (^oC)
1	2.0	
2	4.0	
3	6.0	
4	8.0	

Calculations

1. Using proportions, convert the experimental mass/volume rations to equivalent mass/100 mL ratios.
   a. 2.0 g/5.0 mL = _____ g/100 mL
   b. 4.0 g/5.0 mL = _____ g/100 mL
   c. 6.0 g/5.0 mL = _____ g/100 mL
   d. 8.0 g/5.0 mL = _____ g/100 mL

2. Plot your experimental data on the grid provided.



Questions. Answer in complete sentences on a separate sheet of paper.

1.Use your solubility curve to determine how many grams of KNO_3 can be dissolved in 100 mL of water at the following temperatures:
   a. 30^{o}C b. 60^{o}C c. 70^{o}C

2. Define the terms saturated, unsaturated, and supersaturated

3. Classify the following KNO_3 solutions as saturated, unsaturated, or supersaturated. Explain your answer!
   a. 75 g KNO_3/100 mL H_2O at 40^{o}C
   b. 60 g KNO_3/100 mL H_2O at 50^{o}C

4. How does the solubility of a gas change with increasing temperature? Draw a rough sketch showing the general shape of a solubility curve of a gas.